

*In determining the monthly percentage of weather and temperature combined, the Pacific coast states are not included. †The monthly percentage of weather and temperature combined is determined by multiplying the percentage of weather by 6, and the percentage of temperature by 4, and dividing their sum by 10. ‡The forecasts of temperature in districts east of the Rocky Mountains for July, 1889, were, for the first time, made with reference to the maximum temperature alone; that is, a prediction of warmer or cooler indicated that the maximum temperature of the day designated would be higher or lower than the maximum of the previous day.

FORECAST FOR 48 HOURS IN ADVANCE.

Appreciating the great importance that long time predictions possess for the general public the Chief Signal Officer authorized forecasts for forty-eight hours, covering the second day, in advance. Such forecasts were optional with the predicting officer and were only made when clearly in the public interest, and covered, in all cases, considerable areas of country, and were not confined to localities.

Percentage of verifications of forecasts made for second day in advance: Number of predictions made: weather, 19; temperature, 41. Percentages of verifications: weather, 67.1; temperature, 71.5. Weather and temperature combined, 68.9.

CAUTIONARY SIGNALS FOR JULY, 1889.

Statement showing percentages of justifications of wind signals for the month of July, 1889:

Wind Signals.—(Ordered by 1st Lieutenant R. E. Thompson.) Total number of signals ordered, twenty-three; justified as to velocity, wholly thirteen; justified as to direction, twenty-two. All of the signals ordered were cautionary. Eleven signals were ordered for easterly winds, of which ten were justified, and twelve were ordered for westerly winds, all of which were justified. Percentage of justifications, 46.6.

Percentages of local verifications of weather and temperature signals as reported by directors of the various State Weather Services for July, 1889.

States.	Weather.	Temperature.	States.	Weather.	Temperature.
Illinois.....	73.1	75.8	New Jersey.....	83.0	94.0
Indiana.....	78.0	85.0	New York.....	87.0	86.1
Kentucky.....	86.0	90.0	Ohio.....	79.0	87.0
Michigan.....	83.4	83.9	Pennsylvania.....	81.0	91.0
Minnesota.....	71.0	80.0	South Carolina.....	86.0	88.5
Nebraska.....	74.6	85.6			

STATE WEATHER SERVICES.

[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]

The following extracts are republished from reports for July, 1889, of the directors of the various state weather services:

ALABAMA.

The average temperature for the month has been nearly three degrees above the normal, and the month was marked by some very hot days, one station registering as high as 100 and several reporting as high as 98.

At some stations the precipitation has been greatly in excess of the normal, injuring the crops in those localities. The average for the state was 1.93 above the normal.

The seasons have been very good for the production of cotton and corn, and the indications for a good harvest are very flattering, though in some localities worms have made their appearance, and much complaint is made of the damaging effects of rust.

SUMMARY.

Temperature.—Monthly mean, 79.8; highest monthly mean, 86.4, at Columbiana; lowest monthly mean, 75.6, at Valley Head; maximum, 100, at Talladega, 24th; minimum, 62, at New Market and Valley Head, 6th, 9th; range for state, 38; greatest local monthly range, 33, at Montgomery, Talladega, and Valley Head; least local monthly range, 21, at Guntersville and Greensborough. *Precipitation.*—Average for the state, 6.01; greatest, 9.55, at Mobile; least, 1.65, at Talladega. *Wind.*—Prevailing direction, southwest.—P. H. Mell, Signal Corps, Auburn, director.

ARKANSAS.

SUMMARY.

Temperature.—Monthly mean for the state, 80.3; highest monthly mean, 82.5, at Lead Hill; lowest monthly mean, 76.4, at Ozone; maximum, 107, at Lead Hill, 18th; minimum, 53, at Eureka Springs, 30th and 31st; range for state, 54; greatest local monthly range, 49, at Lead Hill; least local monthly range, 19, at Conway.

Precipitation.—Average for the state, 5.04; greatest monthly, 12.00, at Russellville; least monthly, 2.10, at Heber.—Prof. John C. Branner, Little Rock, director; W. U. Simons, Sergeant, Signal Corps, assistant.

COLORADO.

SUMMARY.

Temperature.—Monthly mean, 66; highest monthly mean, 77.3, at Cañon City; lowest monthly mean, 54.9, at Climax; maximum, 107, at Julesburg, 6th; minimum, 25, at Breckenridge, 3d; range for state, 82.

Precipitation.—Average for the state, 1.64; greatest monthly, 3.52, at Julesburg; least monthly, 0.10, at Gunnison.—Prof. F. H. Loud, Colorado Springs, director; T. W. Sherwood, Sergeant, Signal Corps, assistant.

DAKOTA.

SUMMARY.

Temperature.—Monthly mean, 70; highest monthly mean, 73, at Yankton; lowest monthly mean, 58, at Wabpeton; maximum, 106, at Valentine, Nebr., 5th and 6th, and Roscoe, 6th; minimum, 37, at Brookings, 4th, and at New England City, 8th; range for state, 69.

Precipitation.—Average for the state, 3.13; greatest monthly, 7.07, at Webster; least monthly, 0.63, at Fort Buford; greatest daily, 2.89, at Webster, 11th. *Wind.*—Prevailing direction, southeast.—S. W. Glenn, Sergeant, Signal Corps, Huron, in charge.

ILLINOIS.

SUMMARY.

Temperature.—Monthly mean, 74.1; maximum, 102, at McLeansborough, 12th; minimum, 49, at South Evanston, 16th; range for state, 53.

Precipitation.—Average for the state, 4.70.

Wind.—Prevailing direction, southeast.—John Craig, Sergeant, Signal Corps, Springfield, in charge.

INDIANA.

July, 1889, was as wet as well as a cool month. Rains fell quite frequently and at many stations in large quantities during a few hours. Everywhere, in comparison with the normals, the amounts measured were greatly in excess, ranging from 0.67 to 5.56, except at Farmland, where the amount was slightly deficient, 0.15, showing that the rainfall was probably badly distributed. The greatest excess occurred in the southern portion, 2.81; in the northern portion the excess was 2.04; and the least excess occurred in the central portion. The excess for the state over a normal of seven years was 1.85. The rains were frequently accompanied by lightning and thunder, and by hail on the 24th and 26th at Butlerville, and on the 26th at Cannelton, Worthington, Crawfordsville, and other neighboring places; that at Crawfordsville was exceedingly large, nearly as large as hen's eggs, and the track of the storm was about a mile wide. Much damage was done to crops and trees. Some of these storms were accompanied by exceedingly strong winds for a short time.

SUMMARY.

Temperature.—Monthly mean, 73.9; highest monthly mean, 77.3, at Huntingburgh, lowest monthly mean, 7.02, at Columbia City; maximum, 97, at Angola, 2d and 10th; minimum, 50, at Delphi and Columbia City, 6th; range for state, 37; greatest local monthly range, 45, at Maury; least local monthly range, 21, at Butlerville. *Precipitation.*—Average for the state, 5.41; greatest, 10.50, at Marengo; least, 3.10, at Marion.

Wind.—Prevailing direction, southwest.—Prof. H. A. Huston, La Fayette, director; C. F. R. Wappenhans, Sergeant, Signal Corps, assistant.

IOWA.

July, 1889, averaged nearly normal in temperature, rainfall, and cloudiness; southerly winds and calms prevailing; it was, therefore, mainly a favorable month for crops.

The mean temperature of the air was but very little above normal. The first two decades were decidedly warm, being 2 above normal; the last decade was markedly cool, being over 3 below normal. Nine of the ten hot days of the month fell in the first two decades; and the 1st, 8th, and 18th were the hottest of these. The last two days were the coldest, being 10 below normal, that is, corresponding to the normal temperature of middle September.

The mean cloudiness was less than normal, and while we had 13 clear days there was only 1 cloudy day during July.

The total rainfall during July averaged about normal for the entire state. At the central station it exceeded normal by 14 per cent. Along the Mississippi, from Lee to Jackson counties, the rainfall exceeded 4.00, nearly reaching or exceeding 7.00 at Denmark, Muscatine, and Clinton. A broad belt extending eastward from Harrison and Page to Johnson and Linn counties, also received over 4.00 of rainfall, reaching 7.00 locally in Jasper county. The northwest, as far as Kossuth and Harrison counties, generally received over 5.00, exceeding 7.00 in Monona and Sac counties.

The total rainfall was least in the north and northeast, from Concord to McGregor, and from Mitchell county to Buchanan county; throughout this territory, amounting to nearly one-eighth of the state, the rainfall was insufficient, being less than 2.00. From Concord over Butler to Bremer county the rainfall was even less than 1.00. The territory of Iowa not above specified received sufficient rainfall, from 2.00 to 4.00.

The greatest rainfall occurred on the 2d in the southeast, on the 8th and 9th in the north, on the 13th and 14th from Audubon and Adams counties east to the Mississippi, on the 17th in the extreme southeast, on the 25th in the northeast. The highest single rainfalls reported are nearly 5.00 in Monona county

on the 8th, in Sac county on the 13th, and in Lee county on the 16th.—*Dr. Gustavus Hinrichs, Iowa City, director.*

IOWA WEATHER CROP BULLETIN SERVICE.

The past month has been unusually favorable for growing crops and for harvesting. The early part of the month, with the exception of the 8d, 4th, and 5th, was remarkable for its high temperature, no general but many local and severe rain storms. The middle of the month brought general rains with continued high temperature. Scott county reported the heaviest single rainfall, 5.14 inches having fallen at Davenport on the 14th during four hours. The last part of the month was characterized by a decided deficiency both in precipitation and in temperature. Severe hail storms occurred on the 28th in the counties of Cerro Gordo and Hamilton, doing considerable damage to corn. Light frosts, doing no damage, were reported from Adair county on three mornings of the last week. With the dry weather came an abundance of sunshine, which afforded a most favorable opportunity for haying and harvesting. The hay crop has been above the average, and most of it was gathered in good condition. Oats, wheat, and other small grain gave an exceptionally large yield.

SUMMARY.

Temperature.—Monthly mean, 73.8; highest monthly mean, 79.1, at Washington; lowest monthly mean, 69.5, at Hampton; maximum, 102, at Blakeville and Jefferson, 18th; minimum, 46, at Hampton, 30th, Bancroft, and Amana, 31st; mean maximum, 94.4; mean minimum, 52.6; greatest local monthly range, 50, at Glenwood, McGregor, and Jefferson; least local monthly range, 32, at Independence; range for the state, 56; mean monthly range, 41.8.

Precipitation.—Average for the state, 4.22; greatest, 8.50, at Glenwood; least, 1.19, at Washington.

Wind.—Prevailing direction, south.—*G. M. Chappel, Sergeant, Signal Corps, Des Moines, in charge, Iowa Weather Crop Bulletin Service.*

KANSAS.

The month was characterized by three hot waves, and three wet or rain-waves. The former spread over the western division, and extended into the middle, but failed to reach the eastern; while the latter were felt mainly in the eastern and middle, affecting the western division principally in its extreme northern and southern counties. The wet weather has seriously interfered with the proper handling of wheat and oats, but, as a compensation, gives a spring-like appearance to all vegetation, and has increased the yield of corn, potatoes, and hay, and given a fine prospect for fruit.

SUMMARY.

Temperature.—The temperature is deficient in the eastern and the larger part of the middle division. This deficiency is greatest in the northeastern and gradually diminishes as it proceeds south and west; in the extreme northeast it amounts to about 3, in Leavenworth to 2.5, in Douglas to 2, in Shawnee to 2.3, in Woodson to 1.3, in Montgomery it has disappeared, the mean being normal. A slight excess in Labette and Cherokee, while the deficiency extends to the west of Montgomery, amounting to 2.4 in Chautauqua, but diminishes in Cowley, and is only 0.6 in Sumner. West of Sumner it gradually changes, being slightly in excess in the central counties of the western division. In the northern counties the deficiency continues to the west line of the state. Hot waves occurred on the 5th and 6th, 16th and 17th, and 26th and 27th. The second one was the most extensive. There was an increasing temperature during the first half of the month, culminating in the second hot wave, since which it has been diminishing. The average temperature of the middle division is 5 in excess of that in the western, and 1.3 in excess of the average of the eastern.

Precipitation.—The average rainfall for the state, is 4.65. In the western division it is 2.77, in the middle 4.97, and in the eastern 6.20. In the eastern tier of counties, south of Atchison, the rainfall is deficient, amounting to 1.78 in Leavenworth and 1.64 in Bourbon, being nearly uniform. It changes to an excess in the next counties west, being about 0.40 excess in Franklin, 1.99 in Douglas, 4.15 in Shawnee, 4.11 in Cloud, 1.67 in Woodson, 3.18 in Montgomery, 4.70 in Chautauqua from whence it diminishes west, being 4 in Sumner, about 0.50 in southeast part of Ford, while in the central and northwest part of Ford there is a deficiency of 1.48, which increased to the Colorado line. Three rain-waves crossed the state this month; the first occurring on the 8th and 9th, the second on the 13th and 14th, and the third extending from the 18th in the western division to the 25th in the eastern, both dates inclusive. It was during this last rain-wave that nearly all of the excessive rains occurred. Entering the state in Doniphan the rainfall for the month is about 4. This rapidly increases towards the southwest, being 8.62 in the northeast part of Pottawatomie and reaching 10.00 in Riley; after which it diminishes, being 5.05 in Dickinson, 3.65 in McPherson, and 2.99 in Harvey, whence it rapidly increases to 7.00 in the southwest part of Reno, which amount extends southeast through Sumner, and appears again in Chautauqua and Montgomery. From Reno the rainfall diminishes to Comanche, in the western part of which it is 2.35, but now rapidly increases to 7.59 in the southwest part of Clark, but rapidly diminishes again west of Meade. The 10.00 rainfall in Riley falls to 8.11 in Shawnee, 7.73 in Coffey, and 6.00 in Woodson. Northwestward it falls to 8.29 in Cloud, and increases thence to 11.75 in the northwestern part of Jewell, after which it diminishes towards Colorado, being 8.00 in Decatur, and 5.50 in Rawlins. From the north the monthly rainfall rapidly diminishes towards Ellis and Trego, but slowly diminishes from Trego to the west line of the state. There is a slight increase in Lane and Ness, otherwise the diminution from Barton west is tolerably uniform.

Wind.—Prevailing direction, south.—*Prof. J. T. Lovewell, Topeka, director; T. B. Jennings, Sergeant, Signal Corps, assistant.*

KENTUCKY.

SUMMARY.

Temperature.—The mean temperature of the state for the month, as deduced from the tri-daily observations, was 75.1; from the average of the mean maximum and minimum temperatures, 76.4. These figures show the temperature of the month to have been about 2.0 less than the normal. The highest recorded was 98, at Richmond, 7th, and the lowest 50, at Pellville, 16th. The average monthly range of temperature was 32.9; the greatest 43°, at Pellville, and the least 21, at Franklin. The average warmest day of the month was the 9th, and the average coolest the 4th. The temperature was remarkably uniform throughout the month, and the periods of excessive heat were very few and of short duration.

Precipitation.—The average rainfall for the month was 5.62, which is about 1.00 in excess of the normal. The largest monthly rainfall, 8.75, occurred at Bowling Green, and the smallest, 2.86, at Ashland. The precipitation was very unevenly distributed throughout the state, the southern and western portions reporting a large excess, while in the northern and eastern portions a considerable deficiency exists. At Louisville on July 31st the rainfall for the year since January 1st was 8.91 less than the normal amount. Excessive rains fell in most parts of the state on the 28th. The average number of rainy days for the month was 10; cloudy, 12; partly cloudy, 10; and clear, 11.

Wind.—Prevailing direction, southwest.—*Dr. E. A. Grant, Louisville, director; Frank Burke, Sergeant, Signal Corps, assistant.*

LOUISIANA.

There was quite a heated spell from the 14th to the 23d during which the maximum temperature was generally between 90 and 98 at the majority of stations. The minimum temperatures of the month occurred on the 28th to 31st in all sections of the state. The average temperature of the month for the state was within a few tenths of a degree of the normal for the month, and the rainfall was slightly in excess as compared with the normal for the state. The excess of rain in the northern section of the state was 1.50, and in the southern section less than 0.20.

SUMMARY.

Temperature.—Monthly mean, 82.1; highest monthly mean, 84.3, at Winnfield; lowest monthly mean, 78.2, at Amite; maximum, 102, at Cameron, 21st; minimum, 53, at Convent, 31st; range for the state, 49; greatest local monthly range, 44, at Clinton; least, 19, at Shell Beach; mean daily range, 18.8.

Precipitation.—Average for the state, 5.82; for the northern section, 5.50; southern section, 6.04; greatest local monthly rainfall, 10.49, at Houma; least, 2.13, at Minden; greatest daily rainfall, 4.07, at Monroe, 22d.

Wind.—Prevailing direction, southwest.—*R. E. Kerkam, Sergeant, Signal Corps, New Orleans, in charge.*

MICHIGAN.

The temperature for the month has been below the normal in all sections. The rainfall for the state has been below the normal. The remarkable features were the heavy rainfalls of the 18th in the southwest portion, and of the 27th in the central portion.

SUMMARY.

Temperature.—The mean temperature for the month, 68.5, is 2.7 below the normal of fourteen years. The temperature was below the normal in all sections. The highest mean temperature, 76, occurred on the 9th, when the temperature was 3 below the normal, and the lowest, 62, on the 14th, 15th, and 31st, when it was 9, 11, and 10, respectively, below the normal. The highest mean daily temperature in the past fourteen Julys, 85, occurred on the 17th, 1878, and the lowest, 60, on the 4th, 1882; the highest monthly mean, 74.3, occurred in 1876-'78, and the lowest, 66.7, in 1884. The maximum, 102, occurred at Lathrop, 7th, and the minimum, 33, at Evart, 24th. Light frost was reported in northern portion on 24-25th, but no damage was reported.

Precipitation.—The average rainfall for the month, 2.65, is 0.67 below the average of fourteen years. The rainfall was above the average in the upper peninsula, and generally below the average in the southern. The counties of Gratiot and Montcalm in the central section, and Allegan, Berrien, Calhoun, Branch, Hillsdale, Kalamazoo, Lenawee, Saint Joseph, and Van Buren in the southern section, had rainfalls above the average, also the counties of Benzie, Crawford, and Grand Traverse in the northern section, while the remaining portion of the state received a rainfall of less than the average amount. The heavy rainfall of the 18th, in the southwest portion of the southern section, was remarkable for the amount of rain that fell in so short a period, the storm lasting only about six hours, and in some places ten hours, and the rainfall recorded by the gauges was from 3.00 to 5.00. The largest amount recorded by any one station was 4.90 at Sturgis, and the next largest amount was 4.69 at Colon, both stations in Saint Joseph county, and within a few miles of each other. The largest amount of rainfall recorded for the month, 6.83, occurred at Colon, and the least, 0.69, at Port Huron. The heaviest rainfall in the past fourteen Julys, 5.68, occurred in 1883, and the least, 1.40, in 1886.

Wind.—Prevailing direction, southwest.—*N. B. Conger, Sergeant, Signal Corps, Lansing, director.*

MINNESOTA.

The temperature over the state was quite uniform and differed but slightly from the normal, the variation being but 1.0, which was a deficiency. The

average precipitation, 2.93, is about 25 per cent. less than the July normal. Geographically the rainfall was not evenly distributed. There was more than 40 per cent. of an excess in the vicinity of Lake Superior; the counties south of the centre of the state and between the Mississippi and Minnesota rivers received about the usual amount for July; in other portions of the state the precipitation was deficient, notably so in the northwest, near the Red River, where the deposit was deficient about 60 per cent.

SUMMARY.

Temperature.—Monthly mean, 69.5; highest monthly mean, 72.7, at Pine River Dam; lowest monthly mean, 63.0, at Pokegama Falls; maximum, 100, at Farmington, 7th; minimum, 36.0, at Pokegama Falls, 30th; range for state, 64.0; greatest local monthly range, 54.0, at Pokegama Falls and Moorhead; least local monthly range, 34.0, at Duluth; greatest daily range, 45.0, at Saint Vincent, 10th; least daily range, 4.0, at Duluth, 9th, 19th, and 25th.

Precipitation.—Average for the state, 2.93; greatest, 5.53, at Duluth; least, 1.23, at Saint Vincent.

Wind.—Prevailing direction, south.—*John Healy, Private, Signal Corps, Saint Paul, in charge.*

MISSISSIPPI.

SUMMARY.

Temperature.—The month showed but slight variations in mean daily temperature. The normal mean monthly temperature for the state in July is 81.3, and for this July it was 81. The month began with a mean temperature of 80, over the state. This fell to about 75 on the 6th, rose to 80 about the 10th, and continued above 80 until the 27th, when it fell again, reaching the lowest mean temperature of the month, about 73, on the 31st. The daily range was never very great, its values falling generally between 10 and 20. The greatest monthly range was at Columbus, from 104 on the 19th, to 60 on the 6th. The extremes in the state were 104 at Columbus, 19th, and at Meridian, 20th and 24th, and 54 at Holly Springs, 31st. Columbus had the highest monthly mean, 84.4, and Corinth the lowest, 77.2. The temperature during the month was very favorable to the growth of cotton.

Precipitation.—The average number of days on which rain fell was twelve, the actual number of rainy days varying from four at Hernando, to twenty-two at Summit. The average rainfall was 5.42, being 1.68 more than the normal for July. The deficiency since January 1st, has by this excess been reduced to 7.83. The heaviest rains in twenty-four hours were at Natchez, 2.00, 25th; Summit, 2.31, 30th; Waynesborough, 2.00, 7th; Rienzi, 2.79, 14th; Louisville, 2.15, 30th; and an unmeasured fall in the vicinity of Winona on the 30th, which must have exceeded 3.00. Electrical excitement was shown at almost every rainfall. It was very marked in the general rain and wind storm of the 28th and following days. During this storm the wind was northerly and cool. A very destructive cloud-burst or local rainfall occurred on the 30th in Montgomery and adjoining counties, over an area about thirty miles square.—*R. B. Fulton, Signal Corps, University, director.*

MISSOURI.

SUMMARY.

Temperature.—The mean temperature for July was 76.7. The highest temperature reported was 107, at Protem, and the lowest, 46, at Ozark. The average of maximum temperatures was 82.8, and the average of minimum temperatures 57.2, making an average range of 25.6. The highest temperatures occurred on the 7th, 13th, 17th, 18th to 22d, and 27th, and the lowest on 30th and 31st.

Precipitation.—The average precipitation, 2.93, was 0.11 below the July normal. The greatest amount of precipitation reported was, 6.78, at Keokuk, Iowa, and, 6.65, at Ironton, and the least, 1.02, at Sedalia. In the state as a whole precipitation occurred on 24 days. The greatest number of days of precipitation in any one place was 16 days at Cairo, Ill., and the least, 4 days, at Carthage.—*Prof. Francis E. Nipher, Saint Louis, director.*

NEBRASKA.

The month has been, both in temperature and rainfall, a month of extremes. The temperature has never risen so high nor fallen so low, nor has there been so large a rainfall in July since the organization of the service; the maximum temperature has not been exceeded in any month and the rainfall only in the month of June, 1883.

SUMMARY.

Temperature.—The mean temperature has been 2.0 below the normal, but there passed over the state on the 6th and 7th a hot wave, bringing the highest temperatures on record, reaching 111 at Mullen and nearly as high throughout the western part of the state generally, but diminishing as the wave moved eastward, giving temperatures of from 92 to 100 in the eastern part of the state. The minimum for the month was 38, at Kimball, which is exceedingly low for July.

Precipitation.—Excepting in the western portion of the state the rainfall has been excessive. The normal rainfall for July is 4.40. The rainfall during the present month has ranged from 1.29 at Bingham to 13.20 at Minden. The whole central portion of the state has been deluged with rain, rendering harvesting difficult and spoiling considerable grain.—*Prof. Goodwin D. Swezey, Crete, director; G. A. Loveland, Corporal, Signal Corps, assistant.*

NEVADA.

SUMMARY.

Temperature.—The weather during the past month has been unusually warm

in all sections of the state; there was a very large percentage of sunshine, each station having an average of a little over twenty-four clear days. During the last few days of the month smoky and hazy weather prevailed to a considerable extent all over the state. Two well defined warm-waves passed over the state, the first from the 30th of June to the 5th, and the second, which was by far the most intense, from the 27th to the 30th. Nearly all of the highest temperatures reported occurred on the 29th. The mean temperature for the state, 76.1, is only 0.5 higher than the average, but the number of stations which reported maximum temperatures above 100 this month is far greater than that reported during the same month last year. The temperature ranged from 119 at El Dorado Canyon, 27th, to 36 at Elko, 16th; range for state, 83.0.

Precipitation.—There were no general and but very few thunder and hail storms during the month. The rainfall, which was very small and much below the average, was very unevenly distributed, and fell chiefly in the southwestern part of Elko county, central portion of Esmeralda county, and in Lincoln county. The total absence of rain in the remainder of the state has greatly injured crops of all descriptions. Farmers are complaining of lack of water in streams and springs, and predict a hard time for themselves and the cattlemen. Cattle all over the state are suffering from this disastrous drought. Of twenty-nine reporting stations this month only five reported rain, while during the same period last year rain fell at nineteen out of a total of thirty-three stations, and was well distributed.—*Prof. Chas. W. Friend, Carson City, director; H. F. Alciatore, Private, Signal Corps, assistant.*

NEW ENGLAND METEOROLOGICAL SOCIETY.

SUMMARY.

Temperature.—Monthly mean, 68.4 (107 stations); highest monthly mean, 72.8, at Olneyville; lowest monthly mean, 60.7, at Eastport; maximum, 97, Berlin Falls, 1st; minimum, 33, at Berlin Falls, 16th; range for New England, 64; greatest local monthly range, 64, at Berlin Falls; least local monthly range, 22, at Nantucket; greatest daily range, 50, at Berlin Falls, 6th; least daily range, 0, at Groton, 15th. The average temperature for July for 25 stations, having records for more than 10 years, is 70.3; the average for July, 1889, is 68.5, departure -1.8.

Precipitation.—Average for New England, 7.61 (137 stations); greatest, 17.08, at New Haven; least, 1.72, at Sorrento. The average precipitation for July for 34 stations, having records for more than 10 years, is 4.00; the average for July, 1889, is 7.99; departure, +3.99.

Wind.—Prevailing direction, southwest (23 stations).—*Prof. William H. Niles, Boston, Mass., president; Prof. Winslow Upton, Providence, R. I., secretary; L. G. Schultz, Sergeant, Signal Corps, assistant.*

NEW JERSEY.

SUMMARY.

Temperature.—The mean temperature, 73.4, is 1.1 below the average for the month, and 2.3 above the average for the corresponding month of 1888. The highest temperature recorded was 96, and the lowest, 48, as against 99 and 45, respectively, during July, 1888. The highest temperatures were generally recorded on the 8th, 9th, 10th, and 14th, and the lowest on the 15th, 16th, 18th, and 24th.

Precipitation.—The average for the state, 10.19, is 5.87 above the average for the month, and is 6.79 above the average for the corresponding month of 1888. The rainfall was very unevenly distributed. The fierce downpour on the 30th and 31st did considerable damage, especially in the vicinity of Plainfield and the Oranges. At Plainfield three dams gave way and the entire town was flooded. Several large ice houses were destroyed and some of the finest residences were damaged. All the Oranges were flooded and many houses were damaged or destroyed. Fritz's dam was swept away, and the waters almost completely wrecked Apples Park. The tracks of the Erie Railroad were badly undermined and all traffic was stopped. In East Orange many elegant residences were in an open sea, fences, roads, and all landmarks having disappeared. The low meadows along the Passaic River and its branches were flooded, destroying thousands of acres of hay. This crop is estimated at \$5.00 per acre, which shows a loss of from \$60,000 to \$65,000. The most remarkable features of the month were that the thunder-storms were generally distant, with almost a total absence of high winds. The rainfall at South Orange, 18.58, is phenomenal, and the wonder is that the damage is not greater than it was. Five stations report a total for the month exceeding 14.00, three exceeding 12.00, and ten 10.00. The excess (above the average) at all stations is from 0.84 on the Atlantic coast to 14.26 at South Orange.

Wind.—Prevailing direction, southwest.—*Prof. George H. Cook, New Brunswick, director; E. W. McGarr, Sergeant, Signal Corps, assistant.*

NEW YORK.

SUMMARY.

Temperature.—The highest temperature, 100, at Utica, 9th, and the lowest, 34, at Middleburgh, 14th; mean temperature for the state, 69.8. The greatest local monthly range of temperature was 57, at Middleburgh, and the least was 23, at Erie, Pa. The temperature was generally below the normal, excepting at Central Park, New York City, where it was 1.9; Factoryville, 0.2; Humphrey, 1.5; Potsdam, 1.8; Palermo, 1.0; Palmyra, 1.2; Rondout, 1.6; and Utica, 1.0 above.

Precipitation.—Average for the state 3.88. The rainfall was generally above the average, excepting at Erie, Pa., where it was 1.80; Humphrey, 0.76;

Rochester, 0.07; and Oswego, 0.20 below. The greatest monthly rainfall was 14.07, at White Plains; and the least was 1.68, at Erie, Pa. Average number of days on which rain fell, 13.

Wind.—Prevailing direction, west.—*Prof. E. A. Fuertes, Ithaca, director; I. W. Brewer, Private, Signal Corps, assistant.*

OHIO.

SUMMARY.

Temperature.—The mean temperature of the northern section was 71.5; of the middle section, 72.5; of the southern section, 74.1, and of the state, 72.7. These means are 0.4, 0.7, 0.7, and 0.6 below the average for the sections and state for July; maximum, 98, at Wapakoneta, 9th; minimum, 46.5, at Wauseon, 25th. This is the highest minimum on record for the month of July since the opening of the bureau. The mean daily range of temperature was 20.3. The greatest daily range was 40, at Wapakoneta, 9th, and the smallest, 5, at Hanging Rock, 24th.

Precipitation.—Precipitation was general and heavy in all sections on the 2d, 3d, 13th, 14th, 15th, 18th, 19th, 28th, and 29th; in the northern section on the 1st and 10th, and in the southern section on the 11th, 24th, and 26th. Local rains occurred in all sections on the 4th, 22d, and 31st; in the northern section on the 30th, and in the middle and southern sections on the 1st, 10th, and 20th. The following unusually heavy rainfalls were reported: 1.16 in one-half hour, at Dayton, 14th; 1.14 in one and one-half hour, at Greenville, 14th; 2.00 in forty-five minutes, at Pomeroy, 30th; 1.87 in one and one-half hour, 18th, and 3.50 in two hours, 18th, at Canton, and 5.50 in three and one-half hours, 18th, at Logan. A severe local storm occurred at Princeton, Butler Co., on the evening of the 18th. The mean rainfall in the northern section was 3.34, which is 0.02 below the average; 4.24 in the middle section, and 5.18 in the southern section. These means are 0.53 and 1.53 above the averages for these sections for July. The mean for the state, 4.25, is 0.68 above the average. The deficiency in rainfall to August 1st amounts to 1.14 in the northern section; 4.29 in the middle section, and 4.97 in the southern section. The average deficiency for the state is 3.46.

Wind.—Prevailing direction, southwest.—*Prof. B. F. Thomas, Columbus, director; Lieut. Charles E. Kilbourne, secretary; C. M. Strong, Corporal, Signal Corps, assistant.*

PENNSYLVANIA.

SUMMARY.

Temperature.—The mean temperature was 71.2, which is about 1.0 below the normal, and 2.0 above the corresponding month of last year. The greatest departures were in the eastern border counties. The mean of the maximum temperatures was 81.3, and the mean of the minimum 61.8. The highest temperatures reported were Charlesville, 96; Hollidaysburg and Greenville, 95; Philipsburgh, Coatsville, Grampian Hills, Bethlehem, New Bloomfield, and Philadelphia, 94. These occurred on the 9th and 10th. The lowest temperatures were Coudersport, 39; New Bloomfield, 40; Wellsborough, Columbus, and Dyberry, 42.

Precipitation.—The rainfall averaged 6.80 for the state, which is an excess of from 2.00 to 3.00. The month was very humid and tropical in character. Rains were frequent, and varied from light to torrential over areas little distant from each other. In many places heavy downpours occurred, which were disastrous, and entirely local in character. On the 30th and 31st very heavy rains occurred over the eastern part of the state, which caused heavy floods. The Schuylkill was reported the highest since the flood of 1869. Its banks were overflowed, and it is estimated that at one time ten feet of water were over Fairmount dam. The largest totals for the month were: Lansdale, 15.02; Ottsville, 13.19; Coatsville, 12.93; Frederick, 12.69; Pottstown, 12.50; West Chester, 12.49; Smith's Corner, 12.30; Point Pleasant, 12.30. The smallest were Greenville, 1.04; Erie, 1.68, and Columbus, 2.00. The excess of rainfall extended into New Jersey, Eastern New York, and Connecticut; also, Delaware and Maryland.

Wind.—Prevailing direction, west.—*Under direction of the Franklin Institute, Philadelphia; T. F. Townsend, Sergeant, Signal Corps, assistant.*

SOUTH CAROLINA.

SUMMARY.

Temperature.—The mean temperature for the month, 79.5, is 0.6 above the normal for the last three years; highest monthly mean, 82.6, at Jacksonborough; lowest monthly mean, 75.8, at Camden; maximum, 102, at Greenwood, 11th; minimum, 51, at Cedar Springs, 6th; range for state, 51. In most instances the maximum temperature occurred on the 11th, and the minimum on the 8th.

Precipitation.—The average rainfall for the state, 7.13, is 1.03 above the normal of the last three years; greatest monthly, 10.8, at Cheraw; least monthly, 2.70, at Timmonsville; greatest daily, 3.38, at Columbia, 30th. Average number of rainy days, 13.2.

Wind.—Prevailing direction, southwest.—*Hon. A. P. Butler, Columbia, director; H. C. Seymour, Private, Signal Corps, assistant.*

TENNESSEE.

SUMMARY.

Temperature.—The mean temperature, 76.8, is very nearly the normal for the past seven years; highest local monthly mean, 81.7, at Woodstock; lowest local monthly mean, 70.3, at Fostoria; maximum, 97, on the 22d, at Watkins, and on the 24th at Hohenwald; this was the lowest July maximum recorded during the past seven years, except that of 1876, which was the same;

the highest being 102, last year; minimum, 56, at Hohenwald, 81st; this, together with the July minimums of 1883 and 1887, is the highest during the period named, and was 10 above the average for that period. The highest temperature was recorded generally on the 10th, 11th, and 24th in the eastern division, and on the 10th, 18th, 23d, and 24th in the other two divisions. The lowest temperature was generally recorded on the 5th. The daily ranges of temperature were less than the normal.

Precipitation.—The average precipitation for the state, 5.33, is 1.29 above the July mean of the past seven years, and is the greatest July average during that period, except in 1884, when it was 5.55. Of this amount the eastern division received an average of a little more than 5.00, the middle division about 6.00, and the western division nearly 4.50. The rains fell in various parts of the state on twenty-eight days, only three days, the 5th, 6th, and 8th, being reported without measurable rain. There were about sixteen days of general rains. The days of the greatest rainfall were the 11th to 14th, 25th, 26th, and 28th. The rains were generally well distributed, although some very heavy local falls were reported. The greatest local daily rainfall occurred at Lawrenceburg, where 7.58 fell from 9 a. m., 12th, to 1 p. m., 13th, twenty-eight hours. The greatest local monthly rainfall was 9.04, at Fostoria, and 9.02, at Ashwood. This amount has been exceeded only once during the past seven years, in July, 1884, when 10.62 fell at Manchester. The least local monthly rainfall was 1.66, at Watkins. Most of the rains during the month were accompanied by electrical disturbances, which in some instances were quite severe, and some of them with high winds, notably on the 14th, 15th, 20th, 24th, and 28th. The storm on the last named date was the most severe and the most widespread during the month, and did immense damage to the growing crops, fencing, and timber, and in some localities, where it assumed almost the character of a tornado, houses were blown down or unroofed.

Wind.—Prevailing direction, southwest.—*J. D. Plunket, M. D., Nashville, director; H. C. Bate, Signal Corps, assistant.*

TEXAS.

SUMMARY.

Temperature.—The mean temperature for the month was from 2 to 3 above the normal over that portion of the state north of the thirtieth parallel and east of the ninety-eighth meridian (west from Greenwich), over the eastern portion of the Panhandle and the extreme western part of the state. Over the other portions of the state, except at Galveston and Brownsville, where the normal prevailed, the temperature ranged from 2 to 6 below the normal. The greatest deficiency occurred at Silver Falls, where the mean temperature for the month was 6 below the normal, and the greatest excess at Dallas, where the mean for the month was 3 above the normal. The mean temperature for July over the state was 80. The highest temperature reported was 108, from Fort Elliott on the 27th, and the lowest, 50, from Hartley on the 28d.

Precipitation.—The rainfall for July was very unevenly distributed, and was from 1.00 to 3.00 below the 18 year normals for the month, except over Dallas, Tarrant, and Johnson counties, where there was an excess ranging from 4.00 to 6.00. The rainfall along the coast was less than 1.00, except between Columbia and Port Lavaca, where from 1.00 to 4.00 fell.—*D. D. Bryan, Galveston, director; I. M. Cline, Sergeant, Signal Corps, assistant.*

Meteorological record of Army post surgeons, voluntary, and other co-operating observers, July, 1889.

Stations.	Temperature. (Fahrenheit.)			Precip'n.		Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean				Max.	Min.	Mean	
<i>Alabama.</i>						<i>Arizona—Cont'd.</i>				
Bermuda f.....	94	70*	76.9	4.07		Benson *.....	102	75	87.5	2.16
Butler f.....	93	68	80.9	6.78		Casa Grande *.....	116	78	93.0	0.00?
Citronelle f.....	99	68	82.1	8.34		Cedar Springs.....				2.60
Columbiana f.....	96	65	78.0	5.03		Curtis *.....		69	77.0	2.53
Decatur (1) f.....				12.63		Fairbank.....				5.19
Decatur (2) f.....	98	64	80.0	10.63		Flagstaff.....	102	40	68.6	5.00
Elkmont f.....	94	66	77.8	8.51		Florence.....	111	66	89.8
Eufaula f.....	96	68	80.0	6.24		Fort Apache.....	102	55	76.2	2.68
Evergreen f.....	99	68	82.0	4.00		Fort Bowie.....	101	62	79.1	2.48
Fayette C. H. f.....	91	63	78.0	8.10		Fort Huachuca.....	96	55	76.0	3.66
Fort Deposit f.....	98	69	81.8	7.22		Fort Lowell.....	111	63	86.6	3.36
Greensborough f.....	93	72	81.7	4.52		Fort McDowell.....	117	67	92.0	0.64
Guntersville f.....	89	68	78.0	2.69		Fort Mojave.....	120	72	94.9	T.
Livingston (1) f.....	94	68	79.5	6.80		Fort Verde.....	110	57	82.6	3.40
Livingston (2) f.....	94	66	79.4	6.27		Gila Bend *.....	112	84	95.1	0.36
Luverne f.....	98	70	82.7	5.19		Globe.....	102			1.36
Marion f.....	94	62	77.4	7.84		Holbrook *.....	100	58	77.3	2.06
Motest f.....	92*	62	79.4	8.66		Lochiel *.....	100	68	84.0	3.77
Mount Willing f.....	94	70	79.5	8.45		Maricopa *.....	115	80	93.7	0.55
Mt. Vernon B'ks.....	100	65	81.0	7.91		Pantano *.....	111	70	86.6	3.22
New Market f.....	88	59	75.7	8.54		San Carlos.....	111	64	85.8	1.67
Opelika f.....	100	66	81.0	4.63		San Simon *.....	110	70	81.8
Pine Apple f.....	100	66	81.4	0.19?		Signal.....	114	68	93.0	T.
Selma (2) f.....	98	67	82.6	4.80		Strawberry.....				2.10
Talladega.....	100	67	82.5	1.65		Teavston.....				1.80
Tuscaloosa.....	91	66	80.6	7.08		Tip Top.....				2.50
Tusculum (1).....	92	68	77.6	8.13		Tombstone.....	99	63	78.6	3.59
Tusculum (2) f.....	94	58	78.8	6.17		Tucson (1) *.....	105	66		5.66
Union Springs.....	98	70	80.8	2.46		Tucson (2) *.....	105	50	73.8	0.00?
Uniontown.....	94	67	80.9	8.73		Volunteer Springs.....	98	26?	67.6	2.50
Valley Head f.....	95	62	75.5	2.86		Walnut Grove.....				2.10
Wiggins.....	102	62	82.8	7.41		Wilcox *.....	105	70	82.9	3.62
<i>Arizona.</i>						Willow Springs (Apache county).....				2.74
Antelope Valley.....				1.67		Willow Sp'gs (Pinal county).....				3.06
Ash Canyon.....				4.42						
Banghart's.....	110			5.50						